REMARKS

Claims 12-21 are pending in the present application. Claims 12-21 have been rejected. Reconsideration and allowance is respectfully requested in view of the following remarks.

The 35 U.S.C. §103(a) Rejection

Claims 12-21 have been rejected under 35 U.S.C. § 103(a), as being unpatentable over Stedman et al. (U.S. Patent No. 3,704,172). Applicant respectfully disagrees with the Office Action rejection.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996).

To establish *prima facie* obviousness of a claimed invention, all claim limitations must be taught by the prior art. *In re Royka*, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 165 USPQ 494 (CCPA 1970).

The Stedman et al. reference merely discloses a dual mode power system in which open-cycle operation is employed for short duration peak power periods and a closed cycle mode is employed for long duration base power periods (Stedman et al. at col. 1, lines 21-27). The Stedman et al. reference discloses that in the open cycle mode, the evaporated diluent (steam) is vented overboard and never to be recirculated in the cell stack. In the Stedman et al. reference heat is removed by the evaporation of the diluent and vented to atmosphere (Stedman et al. at col. 1, lines 60-68). The

Stedman et al. reference explicitly states that the system can reject heat **either** by vapor venting or by radiator means (Stedman et al. at col. 2, lines 1-3). The Stedman et al. reference discloses an evaporative cooling means 30 having a liquid inlet 32 and a vapor outlet 34 for open cycle mode operation cooling (Stedman et al. at col. 2, lines 70-72). A pressure relief means 36 is disposed in the vapor outlet 34 (Stedman et al. at col. 3, lines 1-2). The Stedman et al. reference is silent with respect to condensing the steam that flows out of the fuel cell and recirculating the condensate to be re-evaporated. The Stedman et al. reference is silent with respect to drawing a vacuum in the steam channel. The Stedman et al. reference is silent with respect to passing the steam through a radiator after the steam leaves the fuel cell. The Stedman et al. reference is silent with respect to the steam being condensed to liquid water within a radiator. The Stedman et al. reference is silent with respect to a PEM electrolyte layer. The Stedman et al. reference is silent with respect to operating reactant gases at substantially atmospheric pressure.

The Stedman et al. reference does not disclose flowing liquid water into and through the water flow channel and out of the fuel cell, the water being heated within the water channel by heat produced by the fuel cell; causing the liquid water to boil as it flows through the water channel by reducing the pressure in the steam channel below the vapor pressure of the flowing liquid water to convert at least some of the water to steam that passes through the barrier layer into the steam channel, wherein the pressure in the steam channel is increased or decreased during cell operation in response to the operating temperature of the cell to increase or decrease the operating temperature of the cell to achieve a desired cell operating temperature; and condensing the steam outside the fuel cell and recirculating a portion of the condensed steam back to the flowing liquid water, wherein the steam originated as the flowing liquid water converted into steam and passed through the barrier layer into the steam channel, as is claimed in part in Claim 12. The Stedman et al. reference fails to disclose that the step of reducing the pressure in the steam channel includes drawing a vacuum in the steam channel, and the step of increasing or decreasing the pressure in the steam channel includes passing the steam through a radiator after it leaves the cell and controlling the amount of heat removed from the steam within the radiator, as claimed in part in claim

13. The Stedman et al. reference fails to disclose that steam is condensed to water within the radiator and at least a portion of the condensate is made available for recirculation through said water channels, as claimed in part in claim 14. The Stedman et al. reference fails to disclose flowing liquid water adjacent one side of the barrier layer through first channels formed between one of the cell water transport plates and the barrier layer; drawing a vacuum in second channels formed between the transport plate of the adjacent cell and the other side of the barrier layer to reduce the pressure in the second channels to below the vapor pressure of the water in the first channels to cause the liquid water to boil and produce steam that passes through the barrier layer into the second channels, as claimed in part in claim 16. The Stedman et al. reference fails to disclose that controlling the amount of evaporative cooling includes passing the steam from the second channels through a radiator that includes a fan, and controlling the speed of the fan to control the steam pressure in the second channels, as claimed in part in claim 18. The Stedman et al. reference fails to disclose that the operating temperature of the cell is continuously determined and the amount of evaporative cooling is regulated by adjusting the steam pressure within the steam channels in response to the operating temperature to maintain or change the operating temperature as desired, as claimed in part in claim 19. The Stedman et al. reference fails to disclose that the step of passing the steam through a radiator includes condensing steam to liquid water, wherein some of that condensed liquid water is directed into a water accumulator and recirculated through the first channels as needed as claimed in part in claim 21.

The Office Action admits that Stedman does not explicitly teach that steam that has passed through the barrier layer and through outlet 34 is condensed and returned to the reservoir. The Office Action includes the assertion that Stedman discloses that the steam that is condensed has not passed through the barrier layer (of the open cycle) but is steam exiting the fuel cell at outlet 28 (of the closed cooling cycle). The Office Action erroneously draws the conclusion that since the Stedman reference teaches a closed cooling system that includes condensing the steam in a radiator, then one of ordinary skill would have modified the open cycle cooling loop such that the steam formed in the open cycle cooling loop that exits outlet 34 would be coupled to a

radiator/condenser to recycle the steam similar to the closed cooling loop.

The Stedman et al. reference explicitly discloses a fuel cell with two modes of cooling, the open cycle mode and the closed cycle mode. In the Stedman et al. reference open cycle cooling mode is independent of and separate from the closed cycle mode of cooling with respect to the fuel cell downstream of the evaporative cooling means 30 out through the vapor outlet 34 and exiting out the pressure relief means 36 to atmosphere. An "open cycle" is inherently distinct from a "closed cycle." The Stedman et al. reference is explicit and clear at distinguishing the two cooling cycle modes in the figure and specification at the bottom of column 2 and top of column 3.

Stedman et al. explicitly discloses that the waste heat is rejected either by vapor venting (latent heat evaporative cooling) or by radiator means (sensible heat liquid cooling). Stedman et al. provides a closed cycle cooling mode that does not allow for the steam to pass through the evaporative cooling means 30 out through the vapor outlet 34. The closed cycle cooling mode recirculates the liquid coolant, but does not employ evaporative cooling means 30. The Stedman et al. reference explicitly discloses that in the alternative mode of cooling, i.e., the open cycle mode, the cooling fluid (diluent) is heated and evaporated such that the steam crosses through the evaporative cooling means 30 and flows out of the vapor outlet 34 and flows out the pressure relief means 36 exiting to atmosphere. The steam that is used in the open cycle mode is not piped to a condenser to be condensed and is not returned back to an accumulator for recirculation as a coolant. The evaporative cooling cycle (diluent) vapor of Stedman et al. is discharged overboard, never recirculated. The Stedman et al. reference is silent with respect to drawing a vacuum.

The Stedman et al. reference explicitly teaches the advantage of having two distinct cooling modes, an open cycle mode that vents overboard and a closed cycle mode that cools through a radiator. The capability of the Stedman et al. system to reject waste heat either by vapor venting or by radiator means is particularly advantageous for space shuttle vehicles, where heat rejection by radiator is impossible during reentry, or for satellites which require periodic high power but are limited in their allowable radiator areas (Steadman et al. at col. 2, lines 1-16).

Therefore, the Steadman teaches the principal of operating in two distinct cooling modes; (1) an open cycle cooling mode, (2) a closed cycle cooling mode. Steadman et al. explicitly teaches that the closed cycle cooling mode, which employs a radiator, is impossible to operate under certain conditions, (i.e. reentry of space shuttle). The open cycle cooling mode is employed during such conditions. Stedman et al. explicitly teaches that radiator area is limited. Steadman et al. explicitly teaches that the open cycle cooling mode eliminates the need to size the closed cycle components, (e.g., radiators/condensers) for peak power conditions.

In complete contrast to Stedman et al., the claimed invention causes the liquid water to boil as it flows through the water channel, at least some of the (water) steam passes through the barrier layer into the steam channel and is condensed outside the fuel cell and a portion of the condensed steam is recirculated back to the flowing liquid water, wherein the steam originated as the flowing liquid water is converted into steam and passed through the barrier layer into the steam channel. The claimed invention also includes drawing a vacuum in second channels formed between the transport plate of the adjacent cell and the other side of the barrier layer to reduce the pressure in the second channels to below the vapor pressure of the water in the first channels to cause the liquid water to boil and produce steam that passes through the barrier layer into the second channels.

Since the Stedman et al. reference fails to disclose each and every claimed element as claimed in claims 12-21, then there is no *prima facie* case of obviousness.

Additionally, the Office Action proposes to modify the Stedman et al. device such that the steam exiting the open cycle mode outlet 34 be sent to a condensing/recycling radiator instead of being sent overboard to atmosphere as originally taught in Stedman et al. "One of skill would have found condensing/recycling the steam from outlet 34 obvious in view of the teaching that steam from outlet 28 is condensed/recycled" (Office Action of 4/9/07).

If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed.

Cir. 1984).

The Office Action has suggested modifying the Stedman et al. device to include a radiator to condense/recycle the steam from outlet 34. The Office Action modification renders the Stedman et al. device unsatisfactory for its intended purpose. The modification places a radiator on an open cycle cooling mode system. The steam exiting outlet 34 would no longer be evacuated to atmosphere as originally taught in Stedman et al. The steam would be sent to a radiator to be condensed/recycled. The Steadman et al. reference explicitly teaches the advantage to having an open cycle cooling mode as well as a closed cycle cooling mode. Modifying the Stedman et al. reference as the Office Action had suggested eliminates the advantage of the open cycle cooling mode and actually creates a system that is impossible to use under certain operating conditions, (e.g., reentry of space shuttle). The modification of the radiator, as suggested by the Office Action, adds weight and enlarges the size of the closed cooling mode systems, thus defeating another advantage taught by Stedman et al. (i.e., minimizing the weight and component size of the open cycle system).

Since the proposed modification suggested in the Office Action renders the Stedman et al. dual mode cooling systems unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. If there is no suggestion or motivation to modify the prior art reference, then there is no *prima face* case of obviousness.

Moreover, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

The Office Action suggests (another closed cycle) condensing/recycling the steam from outlet 34 as opposed to discharging the steam overboard to atmosphere in an open cycle cooling mode as taught in the Stedman et al reference. To condense/recycle the steam from outlet 34 changes the open cycle cooling mode of Stedman et al. to a closed cycle cooling mode. The Stedman et al. reference explicitly teaches a dual mode fuel cell having an independent closed cycle cooling mode and an

independent open cycle cooling mode to be used independently. The principle of operation of an open cycle cooling mode includes discharging the steam overboard never to be returned in the cooling loop. There is no recycle of steam condensate in an open cycle cooling loop. Stedman et al. is clear regarding the independent use of and the advantages of the open cycle cooling mode and the closed cycle cooling mode.

The Office Action has proposed modifying the open cycle cooling mode to become a closed cycle cooling mode. The Office Action modification changes the principle of operation of the Stedman et al. invention. Thus the teaching of the Stedman et al. prior art is not sufficient to render the claims *prima facie* obvious.

Reconsideration and withdrawal of this rejection is respectfully requested.

Moreover, the Examiner admits that Stedman et al. does not explicitly state the electrolyte layer is a PEM or the operating temperature of the fuel cell. In fact, the Stedman et al. reference fails to disclose that each fuel cell includes a PEM and operates on reactant gasses that are at substantially atmospheric pressure, and the pressure in the steam channels is controlled to maintain the cell operating temperature between 150°F and 180°F, as claimed in part in claim 15. The Stedman et al. reference fails to disclose that the electrolyte is a PEM as claimed in part in claims 17 and 19. Since the Stedman et al. reference fails to disclose each and every claimed element, then claims 15, 17 and 19 are non-obvious in view of Stedman et al.

Finally, the Office Action asserts that the invention as a whole would have been obvious in view of Stedman et al. despite the fact that the Stedman et al. reference does not explicitly state the electrolyte layer is a PEM or the operating temperature of the fuel cell [between 150-180 degrees F] or [operation of reactant gases are at substantially atmospheric pressure]. The Examiner has applied an impermissible obviousness standard. Merely because the Stedman et al. reference has provided a catchall phrase that "it will readily be understood by those skilled in the art that other fuel gases, oxidant gases and electrolytes known in the art can also be utilized," does not rise to the level of a proper obviousness rejection without evidence on the record supporting the motivation to modify the Stedman et al. reference to read on the claimed invention as the Examiner has asserted. An obviousness rejection cannot be predicated on the fact that one of

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ordinary skill in the art would have the capability to arrive at the invention. That which is within the capabilities of one skilled in the art is not synonymous with obviousness. The prior art must supply sufficient impetus to have led one of ordinary skill in the art to modify the teachings of the reference to make the claimed invention. (*Ex parte Levengood*, 28 USPQ2d 1300 (BPAI 1993)). The Stedman et al. reference is silent with respect to a PEM electrolyte, operation of reactant gases at atmospheric pressure and maintaining the cell temperature between 150 and 180 degrees F, as is claimed in part in claims 15, 17, and 20. The showing of the motivation to modify the Stedman et al. reference in the rejection must be clear and particular. Broad conclusory statements regarding the teaching of the reference standing alone are not evidence.

The Declaration from Greg Reynolds was submitted in the previous response and entered into the record provides objective evidence which refutes the assertions of the Office Action.

Reconsideration and withdrawal of this rejection is respectfully requested.

Request for Allowance:

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

Respectfully submitted,

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